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## SCORPIONS OF THE GENUS *HADRURUS* THORELL

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### *HADRURUS* THORELL

*Hadrurus* THORELL, 1876, Ann. Mag. Nat. Hist., ser. 4, vol. 17, p. 11; KRAEPELIN, 1899, Das Tierreich, Scorpiones und Pedipalpi, no. 8, p. 187; Pocock, 1902, Biologia Centrali-Americana, Scorpiones, Pedipalpi, Solfugae, p. 5; EWING, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 7; HOFFMAN, 1931, An. Inst. Biol. Mexico, vol. 2, p. 334; WERNER, 1934, in Bronn, Klassen und Ordnungen des Tierreichs, vol. 5, book 8, Pedipalpi, Scorpiones, p. 265.

The scorpions of this genus are popularly called the giant hairy scorpions. This is because of the large, noticeable bristles rather thickly covering the pedipalps, legs, and distal segments of the cauda including the vesicle of the telson. The movable finger of the chelicera is armed on its inferior border with a single large, sharp, darkly pigmented tooth. The ocular tubercle is approximately in the middle of the carapace. Four species are now recognized in the genus. Their venom is not of a lethal nature, even when relatively large quantities are injected in white rats of only 50–60 grams. In general, laboratory and clinical experiences indicate that the venom apparently produces only a local reaction consisting of a badly swollen area around the site of the injection which may become greatly discolored. The swelling may persist for about 5 to 24 hours and is quite painful at first.

**CARAPACE:** Color dependent on species. Six lateral and two median eyes. The lateral eyes are not arranged in a straight row. Posterior and dorsal to the two anterior eyes of each set of three is a raised portion, the lateral superciliary ridges. Median ocular tubercle quite prominent, with fairly well-developed median superciliary ridges. The ocular tubercle is only slightly anterior to the midpoint of the

carapace. Keels poorly developed. Anterior median furrow distinct, while posterior median furrow ends posteriorly as a deep, narrow pit. A broad furrow leads laterally from each ocular tubercle, making the figure of a cross with the median furrows. Posterior to this is another transverse furrow which is deep laterally but quite shallow and indefinite where it crosses the posterior median furrow. Coarsely granulated in general. Usually the interocular triangle very sparsely covered on female but densely covered with medium-sized granules on male.

**DORSAL PREABDOMEN:** Color dependent on species. No keels present on first six segments. Median and lateral keels only poorly developed on seventh segment. Terga generally well covered with small to large granules, but frequently the posterior and lateral margins bear the largest ones. The seventh segment is more densely granulated and bears much larger granules. Sexual differences are noticeable in granule size, but the variation in one sex is great enough to obliterate the value of this factor in sex determination.

**VENTRAL PREABDOMEN:** Color dependent on species. Bristles sparsely scattered over posterior and lateral margins and plane surfaces of the abdominal plates. The third, fourth, fifth, and sixth segments of the female bear a few large granules on the posterior lateral margins of the abdominal plates. On the male these segments are well covered with granules laterally except the sixth, which is quite densely covered. On both sexes these plates are quite smooth except for the extreme posterior edges. The seventh segment has a few large granules in the intercarinal spaces. The median keels of the seventh segment are very poorly de-

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veloped, while the lateral keels consist of a few large granules. Stigma elongate. Sternum subpentagonal, about twice as broad as long, with a deep, T-shaped, median, pit-like furrow. One large bristle and two or three smaller ones on each half. Genital operculum divided medially in both sexes. Genital papilla not present on male. Four to six large bristles on the posterior portion of each lateral half. The basal piece of the pectines broader than long with a deep, narrow, median furrow extending posteriorly about one-third the length, well covered with large bristles. Three elongate anterior lamellae, quite well covered with bristles. About 16 middle lamellae, but number is variable. Subcircular except first, which is large and somewhat triangular. Each lamellae bears two to three large bristles. Fulcra subtriangular and each bearing as many as five bristles. Teeth, 25-40, more numerous and longer on male than on female, very noticeably so on *spadix* and *arizonensis*. On the female the distance from the medial point of attachment of the pectines to the base of the first tooth is much greater than the widest portion across both anterior and middle lamellae. On the male this distance is about the same or less than the combined width of the two lamellae. This sexual difference can be detected with the naked eye and is even present on very young specimens. It is the only reliable and distinct external characteristic for the sexual differentiation of *H. hirsutus*.

CAUDA: Color light to straw yellow with black aculeus. Granules of keels vary from slightly darker yellow to red in color. Segments 1 and 2 lightly bristled but segments 4 and 5 and ampulla densely bristled. Nearly all keels granular and well developed. Inferior median keels all well developed; smooth on segments 1 and 2; granulated on distal end of segment 3; entirely granulated on segment 4; and strongly denticulate on segment 5. Inferior lateral keels well developed; smooth on segment 1; granulated at extreme distal end on segments 2 and 3; somewhat denticulate on segment 4; and strongly denticulate on segment 5. Median lateral

keel incomplete on all segments except the first, where it is distinctly granulated; marked by moderately large granules on distal half of segments 2 to 4; and by large granules on proximal half of segment 5. Superior lateral keels poorly developed but well marked by prominent granules. Dorsal keels are poorly developed but well marked by moderate-sized granules on the first to fourth; lacking on the fifth. Inter-carinal spaces on superior surface of first segment well covered with moderately large granules. Heavy granules also found on ventral and lateral faces of segment 5. Other segments smooth except the dorsolateral areas of segments 2 to 4, which are lightly studded. Telson well covered with long bristles; ampulla subglobose. Ventral surface moderately studded with low, broad granules except at the base where a few large, denticulate, red granules are located. The aculeus is black at the distal half to two-thirds, and the venom orifices are a very short distance from the tip in a dorsolateral position. These apertures are of a somewhat tear-drop shape with the globose portion directed proximad, and receive the venom duct. No subacicular tooth or tubercle.

APPENDAGES: Legs light to straw yellow color with lateral red spots at joints between tarsus and protarsus, between metatarsus and tibia, and between tibia and femur. All legs well supplied with large reddish bristles. Femurs of first pair of legs one-half as long as those of fourth pair; those of legs 1 to 4 have on their inferior face a double longitudinal series of dentiform granulations, which are more distinct on legs 2 and 3 and incomplete and weak on 1 and 4. *H. aztecus* and *H. spadix* show a greater development of these granule rows. Claws, unguicular spines, and pedal spurs well developed. Pedal spurs bear denticulate spines. The unguicular lobe is well developed, but no tarsal spurs are present. The tarsi and protarsi bear rows of spines. Fingers of pedipalps basically light to straw color; tipped with red in some species. The cutting edge of the movable finger bears nine oblique rows of denticulate granules; the most proximal granule of all but the

first row is much larger. The fixed finger bears only seven of these large proximal granules. Flanking these oblique rows on their inner side is a row of nine large, widely spaced dentiform granules on the movable finger but there are only seven on the fixed digit. Each finger bears on its extreme distal point a large, somewhat curved dentiform granule. Hands of the pedipalps moderately bristled. Except for a few smooth patches, the superior surface is covered with small granules interspersed with larger ones. The superior digital keel is poorly developed except on the finger. The inner superior keel is more pronounced and covered with large granules at its proximal end, as is also the inner marginal keel. The exterior marginal keel is densely granulated with large, rounded granules. The inner edges of the superior and inferior surfaces of the brachium are sharp and bear large, more or less rounded, reddish granules. The outer edges are rounded and bear light-colored, rather large, rounded granules over part of their length. The smooth inner surface bears a few large granules but is densely covered with long, stout bristles. The smooth outer surface bears a smooth, poorly developed keel and is moderately covered with long slender bristles. A few weak bristles appear on the inferior surface. On the superior surface are found eight to 10 trichobothria and a dense covering of small granules interspersed by large ones. The inner edge of the superior and inferior surfaces of the humerus bears a row of large, reddish, rounded granules, but the outer edge of the superior surface bears large rounded granules having the same color as the rest of the humerus. An inferior outer edge is lacking. The inner and outer surfaces are moderately covered with large bristles while the superior and inferior surfaces are only lightly covered. The inferior surface is smooth except for a light covering of different sized granules on the proximal half. The superior surface is densely covered with small granules. The inner surface is lightly covered with small granules, among which are dispersed a few large ones. Covering the proximal one-fourth of this surface is a poorly de-

veloped median keel bearing a few large granules. The outer surface is smooth. The inferior, inner border of the movable finger of the chelicera bears a large, black-tipped tooth and a row of bristles extending nearly the proximal half of its length.

**HABITS, HABITATS, AND FOOD:** The members of this genus are burrowing scorpions. They frequently dig down 2 and 3 feet in sandy washes and river banks. Here they remain, even though the burrow has collapsed, apparently finding no difficulty in breathing. A well-fed *Hadrurus* may remain thus buried for four and five months. In experiments, well-fed specimens have been kept in an empty, open fruit jar for nine months without food and water. Specimens taken in the field are generally found under boards, sacks of grain, and rocks; or any place that affords them a cool, dark shelter after a night of prowling. One specimen brought in was found under a large watermelon in the field. Frequently men hauling sand from a wash or river bed will dig them out. These scorpions readily eat roaches, crickets, and spiders. Although they do not eat sow bugs or harvestmen, a hungry specimen will frequently grab one of these, only to reject it. When hungry they will eat hard beetles, such as June beetles, or, as observed in this laboratory and also reported afield, they will eat the softer lizards.

**REMARKS:** The carapace length of some specimens, especially in *H. spadix*, is greater because of an elongation or projection of the anterior median border. Anomalies are also found in pectine teeth. Frequently double-tipped teeth will be found. These are always counted as two since it is clear that separation merely failed to take place. The frequent presence of small pectine teeth indicates a regenerative ability on the part of this genus. Specimens preserved in denatured alcohol and those that have dried before having been placed in preserving fluid tend to lose the yellow and dark pigments, thus making them difficult to classify.

#### KEY TO THE SPECIES OF *Hadrurus*

1. Anterior portion of interocular triangle light yellow or straw color. . . . . 2

- Anterior portion of interocular triangle of a dark brownish to black color.....*spadix* Stahnke
2. A crescentic, darkly pigmented region passing through the ocular tubercle with the horns of the crescent touching the lateral eyes (faint or absent in poorly preserved specimens). The remainder of the carapace of a straw or greenish yellow color.....*hirsutus* (Wood)
- Crescentic region indefinite or lacking and region posterior to it of a very dark color.....3
3. The fingers and hand of pedipalp of one color or the fingers of a slightly darker color.....*arizonensis* (Ewing)
- The fingers of the pedipalps defi-

of the entire carapace and trunk. A few specimens examined had a few indefinitely shaped and distributed yellow spots on the carapace. Whether this was a natural variation or caused by the preserving fluid is not known. These spots were never observed in living specimens. The light yellow color of the appendages stands out in sharp contrast to the dark trunk except for the reddish color of the pedipalp fingers.

CARAPACE: Color blackish to date brown, even the extreme lateral margins. Some preserved specimens displayed one or two yellow patches which seem to be due to the preservative. Median eyes closer together than in *hirsutus* and *arizonensis*. Granules generally larger and more abundant than on other species.

TABLE 1  
*HADRURUS SPADIX*

A.S.C. SPEC. NO.	LENGTH CARAPACE TELSON		ABDOMEN LENGTH PRE- POST-		TOTAL LENGTH	PECTINE TEETH R/L	MOVABLE FINGER LENGTH
Males							
17	10.3	10.2	20.4	39.9	80.8	39/39	10.7
1	11.0	11.2	20.6	43.0	85.8	40/39	11.7
8	11.1	11.5	25.6	48.0	96.2	39/38	13.3
475	11.6	11.5	20.2	48.4	91.7	38/39	13.0
16B	11.8	11.4	31.0	50.2	104.4	37/38	13.3
16A	11.8	11.6	29.5	50.0	102.9	35/35	13.2
15B	11.8	12.1	21.4	51.0	96.3	38/38	13.4
2	12.1	11.6	23.3	52.1	99.1	35/37	14.0
Females							
333.25	10.1	10.0	20.1	37.0	77.2	30/29	10.6
434	10.3	10.0	16.0	36.4	72.7	29/32	10.5
476	11.0	10.3	24.9	40.1	86.3	26/28	11.6
354.0	12.4	12.1	31.2	46.6	102.3	30/30	12.5
3	12.4	12.8	27.4	49.0	101.6	29/30	13.3
15A	12.5	12.2	35.6	47.5	107.8	31/32	13.1
348.1	12.7	12.8	25.8	50.7	102.0	33/31	13.5
7	13.2	12.8	32.8	49.0	107.8	30/30	13.5

nately of a darker color than the hand.....*aztecus* Pocock

**Hadrurus spadix** Stahnke

*Hadrurus spadix* STAHNKE, 1940, Iowa State College Jour. Sci., vol. 15, p. 102.

The outstanding difference in the appearance of this species and the others of the genus is its lack of any yellow coloration within the region of the interocular triangle and the almost uniform date-brown color

DORSAL PREABDOMEN: Entire surface of sclerites dark brown. Granules generally larger and more abundant than on other species.

VENTRAL PREABDOMEN: Color dusky brown intermingled with tan. Teeth considerably longer on male than on female. On the female the most proximal part of the middle lamellae as wide or wider than the length of the teeth; on the male this region much smaller than the length of the

teeth. Teeth: female, 26-33; male, 35-40.

**CAUDA:** Yellow to tan with black aculeus. Keels have reddish granules especially noticeable on segments 4 and 5, but only slightly so on segments 1 and 2. In general the cauda more slender than those of *hirsutus* and *arizonensis*.

**APPENDAGES:** Legs light yellow, strongly contrasting with dark trunk. Granule rows well developed on inferior face of femurs of legs 2 and 3; weaker on legs 1 and 4. Fingers of pedipalps red. This color sometimes fades from preserved specimens. The redness extends proximally along inner marginal and inner superior keels, sometimes to such an extent as to give the superior surface of the entire chela a distinctly reddish appearance. The movable finger definitely longer than the carapace on males; may be as long or longer on females.

**LOCALITY RECORDS:** 1 ♂, no. 1, Cedar Ridge, Grand Canyon, Arizona (D. E. Fuller), G.C.M.<sup>1</sup>; 1 ♂, 1 ♀, nos. 2 and 3, Phantom Ranch, Grand Canyon, Arizona (E. D. McKee), G.C.M.; 1 ♀, no. 7, Grand Canyon Village, Arizona (E. D. McKee), G.C.M.; 1 ♂, no. 8, Hermit Basin, Grand Canyon, Arizona (F. Richardson), G.C.M.; 1 ♀, 1 ♂, nos. 15A and 15B, Wupatki National Monument, Flagstaff, Arizona (unknown), M.N.A.; 2 ♂, nos. 16A and 16B, Wupatki National Monument, Flagstaff, Arizona (unknown), M.N.A.; 1 ♂, 4 ♀, nos. 17, 333.25, 354, 434, 476, Wupatki National Monument, Flagstaff, Arizona (D. J. Jones), A.S.C.; 1 ♀, no. 348.1, Hurricane, Utah (W. J. Gertsch), A.M.N.H.; 1 ♂, no. 475, Wupatki National Monument, Flagstaff, Arizona (Phil Van Cleave), A.S.C.

### *Hadrurus hirsutus* (Wood)

*Buthus hirsutus* Wood, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 108; Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 5, p. 367.

*Buthus emarginaticeps* Wood, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 109; 1863, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 5, p. 367.

*Hadrurus hirsutus* THORELL, 1876, Ann. Mag. Nat. Hist., ser. 4, vol. 17, p. 11; KRAEPELIN, 1899, Das Tierreich, Scorpiones, Pedipalpi, no. 8, p. 188; Pocock, 1902, Biologia Centrali-Americana, Scorpiones, Pedipalpi, Solfugae, p. 6; EWING, 1928, Proc. U. S. Natl. Mus., vol.

73, p. 8; HOFFMAN, 1931, An. Inst. Biol. Mexico, vol. 2, pp. 335-340.

An outstanding characteristic of this species is the dark, more or less crescent-shaped spot passing through the ocular tubercle with the tips of the crescent horns reaching the lateral eyes. The rest of the body, except the aculeus and a few other very inconspicuous spots, light yellow. Sometimes the dark crescent is obliterated in preserved specimens and also apparently becomes less distinct with age. These characteristics are present in very young specimens which quite occasionally may also have faint, irregular, dark spots on both carapace and dorsal surface of the preabdomen. The posterior carapace and preabdomen of live specimens have a greenish hue due to the partially visible body contents.

**CARAPACE:** A blackish, crescent-shaped area passes through the ocular tubercle with the tips of the crescent horns reaching the lateral eyes. Preserved specimens frequently show the spot only faintly or not at all. This spot generally most distinct in the young. The rest of the carapace light yellow. In males the area posterior to the crescent somewhat darker yellow. In live specimens this posterior area may be a greenish hue.

**DORSAL PREABDOMEN:** The entire dorsum light to straw yellow in preserved specimens. Occasionally a very young specimen may have a few diffuse dark brown spots.

**VENTRAL PREABDOMEN:** Preserved specimens do not show contrast between book lungs and rest of ventral plates. Entire ventral surface yellow to light brown. Live specimens have more of a greenish hue on ventral plates but book lungs are whitish yellow. Difference between tooth length of male and female not so noticeable in *hirsutus*. The most reliable sexual characteristic is the difference in length of median free border of most proximal middle lamella, that of the female being definitely longer than that of the male.

**CAUDA:** Entire cauda light to straw yellow except for black-tipped aculeus. Granules on segments 4 and 5 not so

<sup>1</sup> Abbreviations indicate repositories of specimens. G.C.M., Grand Canyon Museum; M.N.A., Museum of Northern Arizona, Flagstaff, Arizona; A.S.C., Arizona State College, Tempe, Arizona; A.M.N.H., American Museum of Natural History, New York.

TABLE 2  
*HADRURUS HIRSUTUS*

A.S.C. SPEC. NO.	LENGTH		ABDOMEN LENGTH		TOTAL LENGTH	PECTINE TEETH R/L	MOVABLE FINGER LENGTH
	CARAPACE	TELSON	PRE-	POST-			
Males							
340.3	7.4	6.7	12.5	25.7	52.3	35/34	7.5
340.4	10.1	10.3	16.2	38.6	75.2	35/34	11.3
339.3	10.3	9.5	23.2	37.6	80.6	36/36	10.6
339.5	13.6	13.6	28.3	53.2	108.7	37/39	15.0
Females							
340.2	5.3	4.7	13.9	17.2	41.1	32/32	5.7
513 (alive)	9.8	9.1	20.1	35.8	74.8	27/28	10.2
339.4	11.3	11.0	20.2	41.6	84.1	30/30	11.7
202	11.9	11.0	30.3	44.2	97.4	27/27	12.8
340.1	12.0	11.2	24.6	42.7	90.5	30/30	11.8
340.5	12.6	12.4	25.4	46.0	96.4	29/28	13.2
339.1	12.7	11.9	23.4	45.3	93.3	31/31	13.2
339.2	13.8	14.9	26.2	50.6	105.5	30/30	14.2
204	14.0	13.3	29.1	50.3	106.7	28/30	14.0
203	14.3	13.8	34.6	51.5	114.2	?/28	14.7
21	15.5	15.0	38.2	59.0	127.7	30/31	17.1

noticeable, because of their light color, as on the other species. Vesicle usually as broad as, or narrower than, segment 5.

APPENDAGES: Legs light yellow in color. Granule rows weakly developed on inferior surface of leg femurs. Pedipalps light yellow in color except for a faint reddish tinge on the fingers. Even granules have only a slightly darker color so that they are not nearly so noticeable as on the other species. Movable finger generally longer than carapace on both male and female.

LOCALITY RECORDS: 1 ♀, no. 21, Yuma, Arizona (I. R. Nielson), A.S.C.; 1 ♀, no. 202, Olginby, California (L. Hedgpeth), A.S.C.; 2 ♀, nos. 203 and 204, Yuma, Arizona (M. Ayers), A.S.C.; 3 ♀, 2 ♂, nos. 339.1-339.5 Cathedral City, California (unknown), A.M. N.H.; 3 ♀, 2 ♂, nos. 340.1-340.5, Indian Wells, California (C. M. Bogert), A.M.N.H.; 1 ♀, no. 513, Brawley, California (B. J. Juvenal), A.S.C.

#### *Hadrurus arizonensis* (Ewing)

*Hadrurus hirsutus arizonensis* EWING, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 9.

This species differs characteristically from *H. hirsutus* in that it lacks a distinct interocular crescent. The horns of the crescent are present but the body is continuous with the date-brown coloring of the posterior part of the carapace. The

dorsal surface of the trunk is a date brown intermingled with gray and yellow. Freshly preserved specimens are of a date brown interspersed with yellow. Some of the living specimens when distended with food appear olive green banded with date brown and gray. This change in appearance is due to the now visible intersegmentary and lateral membranes. Some specimens appear more gray than date brown. Examination under the microscope shows this to be caused by a dusty deposit between the granules of the terga. When specimens are washed this material comes off and the animal appears a deep reddish to blackish brown. Some specimens have a heavier deposit of the dark pigment than others. This characteristic pattern first appears when the scorpion is three weeks old. At first its basic color is tan, but this gradually changes to date brown.

CARAPACE: The lateral margins and the anterior two-thirds of the interocular triangle pale yellow; the rest of the carapace date brown; median ocular tubercle black. Dark pigment generally extends to lateral eyes in the shape of the inwardly curving horns of a crescent. The body of the crescent lost by a posterior invasion of the dark pigment.

TABLE 3  
*HADRURUS ARIZONENSIS*

A.S.C. SPEC. NO.	LENGTH CARAPACE	LENGTH TELSON	ABDOMEN LENGTH PRE-	ABDOMEN LENGTH POST-	TOTAL LENGTH	PECTINE TEETH R/L	MOVABLE FINGER LENGTH
Males							
311.13	4.3	3.8	9.4	13.8	31.3	34/34	4.5
477.1	9.3	8.6	19.1	34.7	61.7	36/34	9.5
11	10.8	10.3	20.5	39.4	81.0	32/33	10.3
194.1	11.5	11.3	25.0	46.7	94.5	34/33	12.0
19	11.6	11.5	22.7	47.3	93.1	35/34	11.8
482.0	12.0	11.7	22.5	46.0	92.2	33/35	12.9
493	12.0	11.8	23.5	49.8	97.1	38/39	13.0
264	12.0	12.4	30.4	49.2	104.0	36/35	12.0
494	12.4	12.3	29.7	51.6	106.0	34/34	12.8
9	12.5	11.9	19.3	50.0	93.7	35/35	12.7
18	12.5	12.1	29.3	51.3	105.2	36/33	13.2
14A	12.8	12.8	23.0	53.4	102.0	39/39	14.4
406	12.9	13.1	28.0	53.5	107.5	34/35	14.1
447.4	13.0	13.0	26.0	53.0	105.0	35/34	14.0
490	13.1	12.5	25.0	51.2	101.8	34/33	13.5
498	13.2	12.6	32.6	52.0	110.4	34/34	13.8
497	13.3	13.0	29.0	52.8	108.1	38/38	13.9
20	13.5	13.2	26.2	54.1	107.0	38/37	14.4
486.0	13.5	13.4	32.3	54.0	113.2	37/39	13.7
491	13.5	13.5	28.0	55.4	110.4	36/35	13.7
506	14.7	14.6	27.3	61.9	118.5	35/35	15.7
Females							
311.12	3.4	3.7	8.7	14.6	30.4	27/27	4.5
311.14	4.1	3.6	6.6	12.7	27.0	25/26	4.3
311.11	4.1	3.9	9.2	13.5	30.7	29/30	4.2
342.10	9.0	8.6	13.5	31.3	52.4	29/27	8.5
500	10.5	10.2	27.7	38.5	86.9	30/29	10.0
504	11.1	10.5	27.4	38.8	87.8	31/33	10.6
124.1	11.4	11.3	26.4	40.2	89.3	29/29	11.2
353	11.6	11.3	28.0	41.1	92.0	29/29	11.0
477.2	11.8	11.2	30.5	41.4	94.9	32/30	11.7
347	12.2	11.2	24.6	44.2	92.2	30/30	11.6
481.0	12.8	11.6	28.7	45.2	98.3	27/26	12.7
265.2	12.8	12.2	26.7	46.2	97.9	28/29	12.2
10	13.0	12.1	17.4	47.6	90.1	29 <sup>1</sup> / <sub>2</sub> /29	12.3
343.3	13.0	12.5	16.0	48.2	89.7	27/27	12.6
194.2	13.1	12.2	31.2	43.7	100.2	28/28	12.5
13B	13.5	13.2	33.7	50.1	110.5	32/34	14.1
505	13.6	12.6	22.4	48.4	97.0	28/29	13.6
61.1	13.6	13.2	31.7	50.8	109.3	28/28	13.2
344.4	13.7	13.3	31.4	49.5	107.9	29/28	12.6
13A	13.8	13.2	27.3	40.6	94.9	32 <sup>1</sup> / <sub>2</sub> /33	14.2
343.9	13.9	12.7	23.2	49.7	99.5	25/24	13.2
201	14.5	13.8	27.6	52.0	107.9	29 <sup>1</sup> / <sub>3</sub> /29	14.5

**DORSAL PREABDOMEN:** Most of the dorsal surface primarily a date brown intermingled with a dusty gray and some yellow. Posterior half of each sclerite quite shiny and nearly black; anterior half grayish. Lateral margins of the preabdomen yellow. Seventh sclerite entirely yellow except for darker granules and a reddish median streak.

**VENTRAL PREABDOMEN:** Most of preabdomen extremely pale green; book lungs very light yellow. Entire pectines wider on male than on female. This difference made up mainly by longer teeth. Teeth: female, 28-34; male, 32-39.

**CAUDA:** Entire cauda light yellow except for black aculeus with reddish base. Granules on segments 4 and 5 quite notice-

ably red. Vesicle usually as broad as or broader than segment 5.

**APPENDAGES:** Light yellow in color. Granule rows fairly well developed on inferior face of femurs of legs 2 and 3; weaker on legs 1 and 4. Pedipalps light yellow in color. Sometimes fingers bear slight reddish tinge other than that produced by the reddish granules. Movable finger may be longer than, as long as, or shorter than, carapace. This relationship is quite variable. However, it is more frequently longer than the carapace on the male and shorter on the female.

**LOCALITY RECORDS:** 2 ♂, 1 ♀, nos. 9, 10, 11, Casa Grande National Monument, Coolidge, Arizona (N. N. Dodge), A.S.C.; 2 ♀, 1 ♂, nos. 13A, 13B, 14A, Boulder City, Nevada (R. K. Grater), A.S.C.; 1 ♂, no. 18, Mesa, Arizona

Jr.), A.S.C.; 1 ♂, no. 482, San Tan, Arizona (Mrs. Betterton), A.S.C.; 1 ♂, no. 486, Mesa, Arizona (unknown), A.S.C.; 1 ♂, no. 490, Citrus Valley, Arizona (N. D. Benson), A.S.C. 1 ♂, no. 491, Buckeye, Arizona (L. Barron), A.S.C.; 1 ♂, 1 ♀, nos. 493 and 504, Kingman, Arizona (E. Railsback), A.S.C.; 1 ♂, no. 494, Scottsdale, Arizona (V. Bolt), A.S.C.; 1 ♂, no. 498, Mesa, Arizona (B. C. Sexton), A.S.C.; 1 ♀, no. 500, Sacaton, Arizona (L. Tibbet), A.S.C.; 1 ♀, no. 505, Tempe, Arizona (H. L. Stahnke), A.S.C.; 1 ♂, no. 506, Parker Dam, Arizona (W. W. Noah), A.S.C.

### *Hadrurus aztecus* Pocock<sup>1</sup>

*Hadrurus aztecus* Pocock, 1902, Biologia Centrali-Americana, Scorpiones, Pedipalpi, Solifugae, p. 7; EWING, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 9; HOFFMAN, 1931, An. Inst. Biol. Mexico, vol. 2, pp. 340-346.

The posterior two-thirds of the carapace

TABLE 4  
*HADRURUS AZTECUS*

LOCALITY	LENGTH		ABDOMEN PRE-	LENGTH POST-	TOTAL LENGTH	PECTINE TEETH R/L	MOVABLE FINGER LENGTH
	CARAPACE	TELSON					
Males							
Tomellín, Oax.	11.5	11.6	27.8	46.1	97.0	37/37	11.5
Zapotilán, Pue.	12.1	13.0	23.5	51.7	100.3	Incomplete	13.3
Females							
Chilpancingo, Gro.	13.0	12.5	27.6	41.4	94.5	29/29	12.0
Iguala, Gro.	14.7	14.0	28.8	48.0	105.5	27/27	14.0
Cuicatlán, Oax.	15.0	14.7	34.0	50.4	114.1	32/32	13.2

(D. K. Millet), A.S.C.; 1 ♂, no. 19, Mesa, Arizona (Mrs. J. L. Lewis), A.S.C.; 1 ♂, no. 20, Gila Bend, Arizona (J. K. Osgood), A.S.C.; 1 ♀, no. 61.1, Tucson, Arizona (E. M. Payton), A.S.C.; 1 ♀, no. 124.1, Granite Reef near Mesa, Arizona (Joe Patterson), A.M.N.H.; 1 ♂, no. 194.1, Stewart Mt. Dam, Arizona (D. LeBaron), A.S.C.; 1 ♀, no. 201, Yuma, Arizona (R. W. Ashe), A.S.C.; 1 ♂, no. 264, Gilbert, Arizona (Diane Smith), A.S.C.; 1 ♀, no. 265.2 (H. G. Troutman), A.M.N.H.; 6 ♀, 1 ♂, nos. 311.11-311.14, 342.10, 343.3 and 343.9, Tucson, Arizona (Peter Steckler), A.M.N.H.; 1 ♀, no. 347, Phoenix, Arizona (R. Johnson), A.M.N.H.; 1 ♀, no. 353, Bumble Bee, Arizona (L. Conaway), A.S.C.; 1 ♂, no. 481, Papago Saguaro National Monument, Tempe, Arizona (E. Pomeroy), A.S.C.; 1 ♂, no. 497, Papago Saguaro National Monument, Tempe, Arizona (C. Fleming,

and the dorsal plates of the trunk are black (very dark brown). The anterior third of the carapace (in front of the ocular tubercle) is light yellowish in color. (Similar to *H. arizonensis* and *H. hirsutus*.) The postabdomen with the vesicle, the pedipalps (except the fingers), and the legs are also light yellow. The fingers are darker (similar to *H. spadix*). In all the males on hand a stronger contrast among the dark and light parts was evident than on the females. In live females one can barely notice the color differences.

**CARAPACE:** On the male, the anterior third (in front of the ocular tubercle) light yellow; remainder black or very dark

<sup>1</sup> Entire description taken from Hoffman, 1931, An. Inst. Biol. Mexico, vol. 2, pp. 340-346.



brown. Anterior part of carapace on female a little lighter than the rest and the granulations few in number and smooth. On the male the light anterior part covered with heavy, but isolated, granules; two transverse furrows in sides of ocular tubercle thickly covered with finer granules of variable size; entire posterior part has numerous large granules arranged in orderly series.

**DORSAL PREABDOMEN:** Dorsal plates of the male black (very dark brown). Those of the female brown with a few diffuse darker spots.

**VENTRAL PREABDOMEN:** Ventral plates of the male more or less blackish and completely covered with punctiform depressions and transverse wrinkles. Patches of granulations of extensive and variable development noted on the first plate, under the pectines and on the sides of all the plates. Ventral plates of the female a

little lighter brown than the dorsal surface. Pectine teeth: male, 37; female, 27-32.

**CAUDA:** Entire cauda a light yellowish color, and more or less the same tone as *H. hirsutus*. Aculeus black. Keels darker, in particular the inferior ones. On the base of only the male aculeus two small oval enlargements.

**APPENDAGES:** Legs of the male light yellowish, but those of the female light yellow ocher. A double longitudinal series of dentiform granules on interior face of femur of legs 1 to 4; well developed on legs 2 and 3, but incomplete and weak on 1 and 4.

**PEDIPALPS:** Light yellowish in color with bristles weaker and less dense than *H. hirsutus*. Fingers darker. Movable finger of the adult male same length or longer than carapace; on female always shorter than the carapace.

